

Managing Oracle Real Application Clusters

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OVERVIEW

Oracle Real Application Clusters is a powerful computing environment and one of the key technologies used to provide high availability and scalability for the Oracle database. This system provides a single image of your database over multiple machines in a cluster and offers transparent application scalability by quickly and efficiently sharing cluster-wide caches for data access. Managing such environments efficiently could be challenging. Oracle Enterprise Manager along with Oracle configuration assistants greatly simplify their management by offering the same familiar interfaces used for single instance management and extending them with cluster specific options.

This paper provides a summary of the key features of Real Application Clusters management and illustrates the benefits of using a common management framework.

INSTALLATION AND CONFIGURATION

Oracle Software Installation on a Cluster

Installation and configuration of Real Application Clusters is made easy by the same tools used to install and configure a single instance database. Oracle Universal Installer (OUI) is Oracle's installation engine that guides the user through the installation steps. OUI's cluster extensions detect if the environment is a cluster and which nodes are part of it. Once your system is prepared for installation, the Oracle installer presents the list of all cluster nodes, allows a subset to be chosen as targets, copies the Oracle software onto the first node and then propagates the software onto the rest of the chosen nodes of the cluster. Along with all the Oracle software, Oracle Enterprise Manager, the central managing console, is automatically installed and setup.

Database Configuration

For any database type installation, the Database Configuration Assistant (DBCA) is automatically launched at the end of the install to create your database and its files, using standard file naming and placement practices (Oracle Flexible Architecture). Database network connectivity is also configured at the same time with no additional information requested.

Customized database installation allows full flexibility in database creation by choosing custom database options, storage parameters, files location, initialization parameters or user-defined scripts to be run.

DBCA can be run in stand-alone mode at any time after the install. The key tasks that can be performed in this mode are the creation of new databases and addition of new instances to a cluster database. With version 9.2 DBCA allows the use of raw devices or cluster file system files as datafiles for your cluster database. DBCA 9*i* and later introduces the concept of database *templates*, which allows administrators to create new databases using a pre-defined template or create a new template (with or without datafiles) based on an existing database. Templates are also more powerful than database creation custom scripts so they can be used for silent (non-interactive) deployment of new databases in a much more efficient manner.

Starting with Oracle9*i* database, DBCA also simplifies the task of adding a new node to a cluster. The wizard guides you through creating a new instance scaling up your system in a few easy steps.

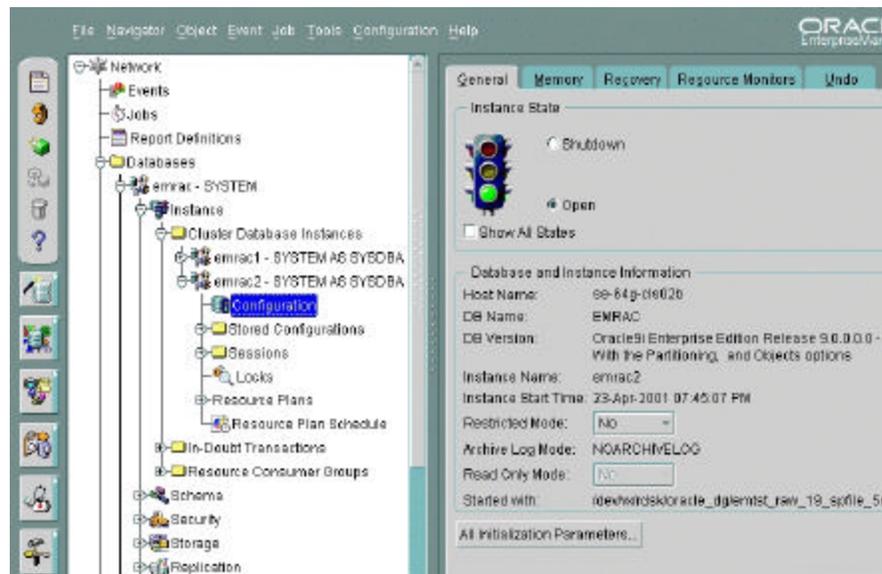
TARGET DISCOVERY

Oracle Enterprise Manager automatically discovers services on cluster nodes and presents administrators with a complete management framework. The cluster databases, their instances and other related services available for management are first discovered by the Oracle Intelligent Agents present on the remote cluster systems and become available on request to the Enterprise Manager console via the Discovery Wizard. To connect to each instance of a cluster database you can specify a valid database username and password and opt to save them encrypted as preferred credentials. Databases on the cluster nodes can then be managed similarly to single instance environments, with some additional tasks available for cluster environments only.

CLUSTER DATABASE INSTANCE MANAGEMENT

Configuration

Database administrators need to know the status of their managed instances at all times, along with other essential instance information, such as instance state and statistics, major instance parameters, and archived log configuration. All these properties are accessible via a comprehensive graphical interface, grouped by area that they affect. These include general instance properties (for example version), memory parameters, user session details, recovery options or resources management information.



Cluster Instance Management

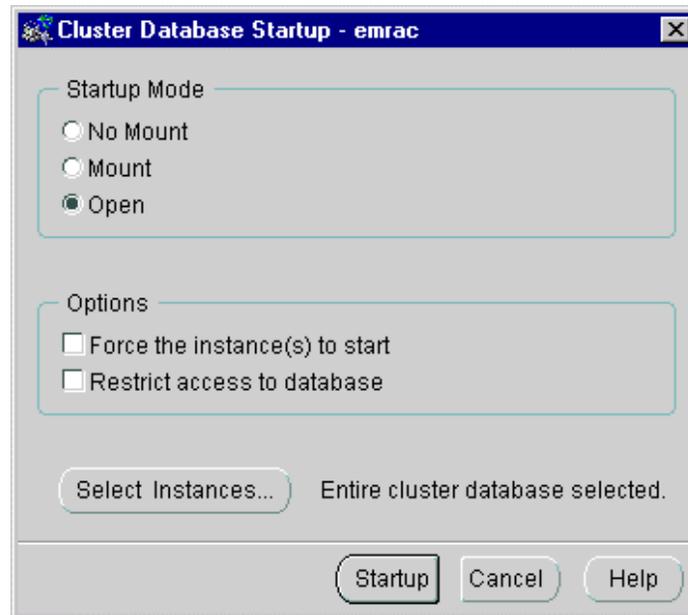
Enterprise Manager also helps you view and set values for all instance configuration parameters, including those specified in a server parameter file of an Oracle9i database or later database, distinguishing between global parameters that apply to the entire cluster database and instance-specific parameters. In addition, Oracle9i and later includes an advisory mechanism that can be used to determine an optimal size for the buffer cache. Enterprise Manager's Buffer Cache Size Advice provides a chart to determine if buffer cache should be grown or shrunk for your present workload. Oracle9i Database Release 2 introduced a series of new advisories for optimally sizing the Shared Pool, Program Global Area (PGA) and selecting an optimal Mean Time to Recover (MTTR) value. These advisories are all available graphically from Oracle Enterprise Manager.

Oracle9i's Automatic Undo Management, which eliminates the need for rollback segments, allows administrators to allocate undo space in a single undo tablespace per instance, instead of distributing it across statically allocated rollback segments. Enterprise Manager 9i and later simplifies the process of creating and setting a new undo tablespace for each cluster instance. The new "Undo" tab displays the name of the active undo tablespace and the current undo retention time. Administrators can modify the retention time based on their largest transaction time and a graphical display of space requirements per minute of retention time can help deciding on an optimal value for it.

For each instance in a cluster database, you also have the option of storing multiple configurations into the Enterprise Manager repository and accessing them at instance startup.

Startup and Shutdown

Entire cluster database or a selected set of its instances and their related services (like listeners) can be started or shutdown as a single operation with Oracle Enterprise Manager.



Starting up a Cluster Database

The intuitive graphical interface offers the option of starting and shutting down different instances of a cluster database and translates that into immediately scheduled Enterprise Manager jobs. The progress and results of these jobs are

graphically displayed as instance or services status. The cluster database instances can also be individually started or stopped bypassing the Enterprise Manager job system, similar to single instance databases.

Instance Status

With a single mouse click users can view the status of cluster database instances and other related services (like listeners) on all the cluster nodes for which a cluster database has been configured.

Node	Name	Instance	Listener
1	se-64g-clis02b		
0	se-64g-clis02a		

Cluster Database Instance and Services Status

Sessions

With Enterprise Manager administrators can view sessions of individual instances in a cluster and can inspect a session in details to determine what SQL statement a user is running. Just like single instance databases, all key statistics are displayed by simply pointing and clicking on that particular user session. The statistics include the user's database connection time, OS user name, machine they are running from, what SQL statement they are issuing, and a detailed description of the SQL statement execution plan. If needed, administrators can terminate sessions directly from this view.

Resource Management

Efficient use of system resources is critical to ensure high priority transactions always complete. Depending on several factors, such as the number of users, hardware configuration and type of activity, system and database performance can suffer. Oracle's Resource Management can help alleviate these problems by optimizing resource allocation. Enterprise Manager's powerful graphical interface allows you to manage the priority level for each set of database users, decide the priority level for each, group them together into distinct sets (Resource Plans) to which you can designate a certain percentage of CPU. An easy-to-interpret graphical interface displays the overall resources distribution. In Real Application Clusters environments, resource management allows each instance to use a different resource plan so that resources on the node where an instance runs can be utilized efficiently. They can be activated and monitored individually at the cluster instance level.

STORAGE MANAGEMENT

Datafiles and Redologs

On most platforms, Real Application Clusters option requires that all instances access unformatted devices on a shared disk subsystem, also referred to as raw devices. The instances write data onto the raw devices to update the data files, control files, and redo logs that all nodes in the cluster share. Raw partitions must be created at the operating system level before creating new datafiles or redologs. Once created, raw partitions are presented in Oracle Enterprise Manager in a similar way single database instance datafiles are, specifying the file name on UNIX platforms or symbolic links to raw partitions on Windows NT. Datafiles or redolog files on raw partitions can be managed just like their regular file systems counterparts. For example, datafiles on raw devices can be taken off line or, you can view their associated tablespaces and their size. Since raw partitions are physically created with a fixed size, the "autoextend" option does not apply. In addition, using Enterprise Manager, redolog groups can be assigned to specific threads of cluster database instances.

Backup and Recovery

Backup and Recovery wizards are designed to help DBAs create scheduled backups and specific types of recovery. The Enterprise Manager interface transparently utilizes many of

the features provided by the Oracle Recovery Manager utility (RMAN) provided with the Oracle database. The Wizards can help specify pre-defined backup strategies, from a complete to specific tablespaces and datafiles backup and recovery, configuration of backups with different attributes or viewing and editing the backup configurations already created in the Backup Configuration Library. The results translate into Oracle Enterprise Manager jobs that are run as specified. For jobs that fail, Enterprise Manager can be setup to trigger an email or page to be sent to the database administrator.

Backing up and recovering a Real Application Cluster database is just as simple. For backup, Enterprise Manager will create jobs that prepare the cluster database based on the specified backup strategy and allows recovery to be performed when needed.

PERFORMANCE MANAGEMENT

Database performance depends on many factors, including effective use of memory, minimizing disk I/O, and avoiding resource contention. Oracle Enterprise Manager 's Performance Manager captures, computes, and presents performance data to enable administrators to balance all these factors. Similar to performance monitoring of a single instance database, these tools can also be used to monitor the cluster nodes and cluster database instances.

Performance Charts

The pre-configured graphical monitors in Performance Manager capture and display applications performance data in real time, which can also be recorded for replay. The monitors can be customized to display information in two- or three-dimensional graphical views and can be extended by defining charts for database scripts, displaying information from Oracle tables, or customize the rate of monitoring.

Key performance metrics are brought together into single overview charts that provide quick access to database performance metrics. Administrators can obtain statistics that represent the aggregate performance of all instances of a cluster database. The statistics are displayed in a number of individual charts, including information on global cache converts or blocks lost or corrupt.

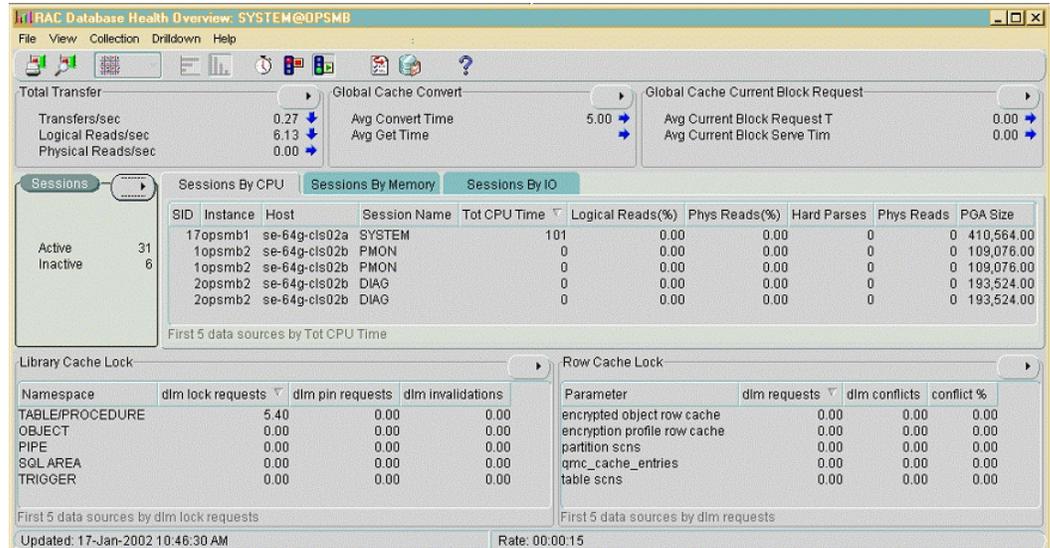
Performance Manager employs a built-in diagnostics methodology that leads the user from overview diagnostics charts to related charts and information for troubleshooting the source of a performance problem. Performance charts can be printed or captured into HTML reports allowing administrators to easily document and share information about the systems they are managing.

Among the Real Application Clusters performance metrics that can be viewed, are:

- Global Cache Converts
- Global Cache Gets
- Global Cache Blocks Lost

- Global Cache Blocks Corrupt

In addition, starting with Oracle9i Database Release 2, a new Performance Overview chart displays at a glance the overall health of your system. This chart provides immediate access to all the key statistics of your environment and offers drill down capabilities for detailed analysis.



Real Application Clusters- Database Health Overview Charts

Top Sessions and Lock Management

The TopSessions charts extract and analyze Oracle performance data by session, automatically determining the top Oracle users, based on selection criteria, such as memory, CPU usage, or file I/O activity. High impact sessions can be investigated directly from the TopSessions charts by examining SQL statements explain plans. Sessions related to individual cluster database instances can be viewed from Top Sessions The Enterprise Manager Tuning Pack's SQL tuning application can also be launched from this point to tune SQL statements for sessions that are causing performance problems.

Performance Manager provides a graphical display of database locks, including details such as the locking user, lock type, object locked, mode held and mode requested. Users that are blocked are highlighted through a graphical tree view that displays waiting sessions as children of blocking sessions. If needed, sessions can be halted directly from the TopSessions and Locks charts.

EVENTS MONITORING

Using the Enterprise manager events system and Intelligent Agents available on the managed nodes, administrators can effectively monitor round the clock any number of

targets, receive alerts when a problem or specific condition is detected and provide an automatic fix for that condition. The events system can be extended to include other third-party applications that detect events independent of the Intelligent Agents.

The Create Event Panel includes a target type Cluster Database or Cluster Database Instance. For these types of targets, the hundreds of pre-defined events that apply to single instance databases apply to cluster environments as well. In addition, cluster database specific events can be registered and monitored for. Many of the statistics collected during performance monitoring can be evaluated as events and administrators can be notified when specified thresholds are reached.

Typically, events that you need to monitor at the cluster database level (for example, events for fault or space management, such as Archive Full, Maximum Extents or Tablespace Full) need to be registered only once with one of the cluster nodes. These events can be saved in the Enterprise Manager repository (Event Library) and re-used, registered against other nodes (instances) of the cluster, should the original one go down. Events that apply to individual instances of a cluster database (such as Instance Activity, Resource Management, Performance, Application Activity or Transaction activity types) can be registered with each instance of the cluster database.

ENTERPRISE MANAGER JOBS

The Enterprise manager jobs system allows you to automate standard and repetitive tasks. Administrators can create and manage jobs, share jobs with other administrators, schedule execution of jobs, and view status of the jobs. Jobs can be scheduled on a single node or multiple nodes in the network where Intelligent Agents are running. Enterprise Manager tasks related to various activities like data management (export, import and load), backup management (backup and recovery), analyze and SQL scripts can be scheduled against cluster database and cluster database instance targets.

REPORTING

Creating reports and having a common view of all related attributes of your managed systems is a critical part of running a business. Oracle Enterprise Manager provides a framework to generate such reports. Specifically, with Enterprise Manager you can select to create custom HTML reports of your cluster database details, schema objects, users, storage attributes and performance. The reports definition page simplifies the selection of items to be included in a report and can easily include custom data retrieved via user-defined SQL statements. You can also generate reports in the context of an object such as a database instance or a tablespace. When connected to a Management Server, reports can be scheduled using the Enterprise Manager job system. Various reports for cluster nodes, cluster databases and instances can be run periodically and published to a known Web location. For example, on the cluster database level, you can generate a report on Storage Configuration listing the status and size of all storage objects (control files, tablespaces,

datafiles, rollback segments and redologs). Similarly, on the cluster database instance, you can generate a report on Instance Configuration, describing the hostname, archivelogs, SGA Information and Initialization Parameters for a specific instance.

CONCLUSION

Setting up and managing a highly scalable Oracle cluster database environment has never been easier. Installation and configuration is done once and transparently propagated to all nodes of a cluster. Starting with Oracle9i database, Oracle Enterprise Manager simplifies the day-to-day administration and monitoring enabling the common Oracle management framework for cluster environments.

The revolutionary Oracle Real Application Clusters environment coupled with a comprehensive management solution, Oracle Enterprise Manager and Oracle configuration tools, deliver a state of the art high-availability solution for your e-business.



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Author: Daniela Hansell

**Oracle Corporation
World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065
U.S.A.**

Worldwide Inquiries:

Phone: +1.650.506.7000

Fax: +1.650.506.7200

www.oracle.com

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